Center Innovation Fund: JSC CIF

Rocket Fuel Synthesis by Fisher-Tropsch Process

Completed Technology Project (2012 - 2012)

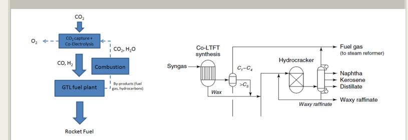
Project Introduction

This study aims to investigate the feasibility of using Fisher Tropsch (FT), a commercial-scale technology that currently produces liquid fuels from syngas (CO & H2), to produce fuels that are compatible with current rocket engine systems. Front-end systems that produce syngas like carbon dioxide (CO2) sequestration or solid waste management systems can be interfaced with the FT reactor to produce fuel for a variety of habitation/space travel scenarios.

While In-Situ Resource Utilization (ISRU) studies for Mars return have emphasized methane fuel, only modest work has been done to develop the methane-powered rocket engine. Developing a process that generates liquid hydrocarbons that are compatible with current engine designs is more economical than developing a methane production process, along with developing and certifying new engines that use methane. Fisher-Tropsch (FT) is a commercial-scale technology that currently produces liquid fuels from syngas (CO & H2). FT could easily produce kerosene-type products, like RP-1, therefore eliminating the need for new engines. Front-end systems that produce syngas can be interfaced with the FT reactor thus integrating ISRU with closed-loop Environmental Control and Life Support Systems (ECLSS). Development Approach: Demonstrate the feasibility of deploying the FT technology to produce RP-1 (kerosene) for a Mars return scenario and for a deep-space/lunar habitat mission. The first scenario will demonstrate integrating FT with gas-phase collection of CO2 and conversion to syngas. The second case will integrate FT with gasification to convert solid waste to syngas. Process development and equipment sizing will follow established methods used for sizing ECLSS technologies. Anticipated Outcomes: A detailed feasibility analysis along with process economics for both scenarios. The process model will specify sizing parameters for the system and the results will discuss FT with respect to other proposed ISRU technologies in order to provide a detailed perspective on process economics.

Anticipated Benefits

Only modest work has been done to develop the methane-powered rocket engine. Developing a process that generates liquid hydrocarbons that are compatible with current engine designs is more economical than developing a methane production process, along with developing and certifying new engines that use methane.



Project Image Rocket Fuel Synthesis by Fisher-Tropsch Process

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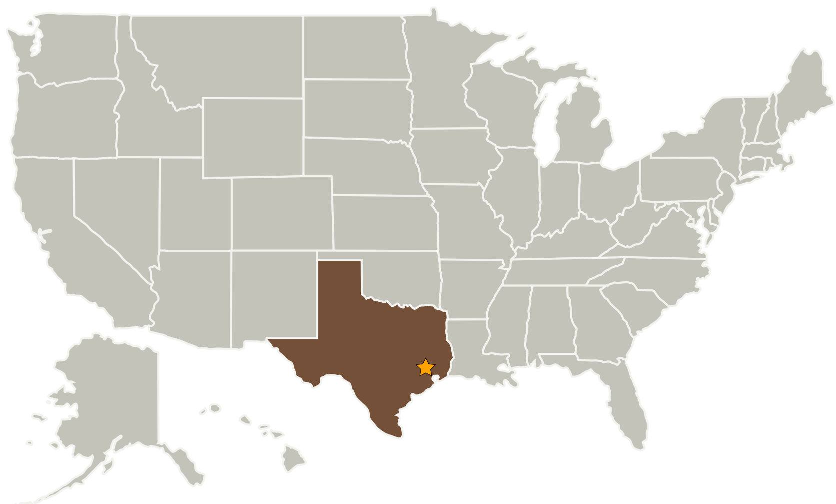
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Johnson Space Center(JSC)	Lead Organization	NASA Center	Houston, Texas
Jacobs Engineering Group, Inc.	Supporting Organization	Industry	Dallas, Texas

Primary U.S. Work Locations
Texas

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Johnson Space Center (JSC)

Responsible Program:

Center Innovation Fund: JSC CIF

Project Management

Program Director:

Michael R Lapointe

Program Manager:

Carlos H Westhelle

Project Manager:

Rama K Allada

Principal Investigator:

Rama K Allada

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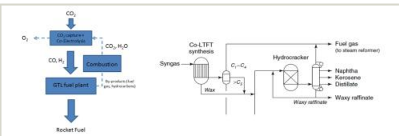
Images



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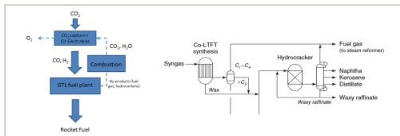
Project Image Rocket Fuel Synthesis by Fisher-Tropsch Process
(https://techport.nasa.gov/image/2240)



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Project Image Rocket Fuel Synthesis by Fisher-Tropsch Process
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Technology Maturity (TRL)

Start: **2**
Current: **2**
Estimated End: **2**

1 2 3 4 5 6 7 8 9

Applied Research | Development | Demo & Test

Technology Areas

Primary:

- TX07 Exploration Destination Systems
  └ TX07.1 In-Situ Resource Utilization
    └ TX07.1.3 Resource Processing for Production of Mission Consumables